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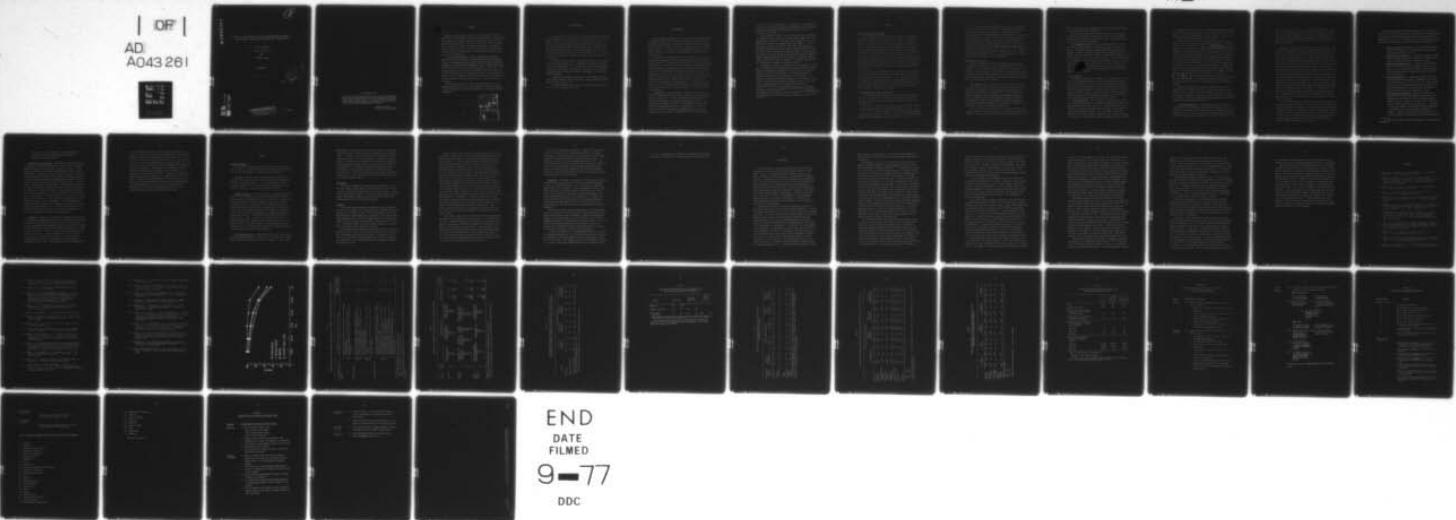
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A STUDY OF THE RELIABILITY, VALIDITY, AND PRECISION OF SCALES TO
MEASURE CHRONIC FUNCTIONAL LIMITATIONS DUE TO POOR HEALTH

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ABSTRACT

Results of psychometric studies of 14 questionnaire items commonly used to define chronic functional limitations due to poor health are reported. *Self-administered questionnaires were used to gather data from 1,209 persons 14 years of age and older.* Data were used to study scalability of items, test-retest reliability of alternate forms of scales, validity of scales in relation to 13 health status variables and age, and precision of scales in detecting differences *in functional limitations.*

Three scales pertaining to chronic limitations in mobility, physical activity, and social role activity functions satisfied the criteria of scalogram analysis. Four-month test-retest reliability estimates for alternative forms were very high. Strong associations *(some curvilinear) were* observed among functional limitations scales, and between these scales and survey measures of physical abilities, general health perceptions, health worry/concern, chronic disease conditions, and age. Measures of physical abilities and functional limitations appeared to define opposite ends of a function-dysfunction continuum.

Statistical modeling of precision indicated that, due to the skewed distribution of scores, large sample sizes would be required to detect differences in functional limitations in studies using only a post-test.

ACKNOWLEDGMENTS

INTRODUCTION

A major purpose of medical care is to maintain or improve health. Policymakers in the medical care arena presumably could make better decisions regarding how the medical care system should be altered if data describing the impact on health of various policies or programs were available. At present, this decisionmaking process is not frequently employed, due in part to the inability to conceptualize or measure health.

Policy options regarding the financing of medical care are currently being evaluated in the Health Insurance Study (HIS), which The Rand Corporation is conducting for the Department of Health, Education, and Welfare.[25] The HIS is a social experiment involving approximately 7,500 individuals (2,700 families) at rural and urban sites in four regions of the country who are enrolled in the study for periods of either three or five years. The study is designed to estimate the effects of coinsurance and deductibles (in the fee-for-service system) and organization of care (prepaid group practice versus fee-for-service) on the demand for health services, on the quality of care given, and on the health status that results. Successful completion of this study, therefore, requires measurement of the health status of participants.

Consistent with the World Health Organization definition of health,[34] physical, mental, and social components of health are being studied in the HIS.[32] A fourth component, physiologic health has also been distinguished for separate measurement. Physical and physiologic components of health are being measured using a multiphasic screening examination and 27 disease-specific tracers.[20] Mental health is being measured using adaptations of the survey measures of Beck,[1] Cantril,[3] Dohrenwend,[5,6] and Dupuy[8] (primarily

those of the latter investigator). Social health is being measured in terms of social participation, using methods derived from Meyers, Lindenthal, and Pepper;[22] Dohrenwend, Dohrenwend, and Cook;[7] Greenblatt;[12] and Renne.[28]

Other measures of health that have not been shown to primarily tap a single physical, mental, or social health component are also being studied in the HIS. Included in this category are function-dysfunction constructs and general health perceptions. Function-dysfunction constructs are being scored from survey measures of functional limitations similar to those developed by Patrick, Bush, and Chen,[27] and by Reynolds, Rushing, and Miles,[29] and from items pertaining to physical abilities constructed by Hulka and Cassell.[16] General health perceptions are being scored from summated ratings scales constructed by Ware and Karmos.[31] A complete description of the HIS measures of health is available elsewhere.[2]

This paper is limited to a discussion of the validity, reliability, and precision of the measurement of chronic functional limitations. As operationally defined in the HIS, chronic functional limitations refer to the inability to perform selected daily activities for more than three months due to poor health. In studies of functional limitations reported in the literature, four types of daily activities are most commonly included: 1) social role activities, such as work, household work, and school work;[10,14,23,24,27,29] 2) self-care activities, such as bathing, dressing, and feeding oneself;[10,14,16,19,23,27,29,33] 3) physical activities, such as walking and physical movements;[10,14,16,19,23,27,29] and 4) mobility, the ability to travel from place to place.[10,14,24,27,29,33]

METHODS

Population and Analysis Sample

In the summer and fall of 1974, initial data were gathered on
all members of 2,506 families residing in a sample of households in
Dayton, Ohio (one of four HIS sites). This sample of households
differed (intentionally) from the Dayton population in several re-
pects: a) only families with heads of households 61 and younger were
included; b) low-income families ($9,000 and below) were slightly
oversampled and no family with an annual income over $27,000 (in 1973
dollars) was included; and c) persons in institutions, in the mili-
tary, and who were receiving care for service-connected disabilities
in Veteran's Administration hospitals were excluded. During the fall
and winter of 1974, a total of 646 families chosen to be representa-
tive of the 2,506 families[21] were offered enrollment in the HIS and
593 accepted.

In the results described below, the analyses are restricted to
data on 1,209 enrollees 14 years of age and older. The average age
of the sample was 34; the range was 14 to 75. Forty-eight percent
were males and 52 percent were females. Approximately 12 percent
were nonwhite. The average number of school years completed was 12.6.
Reported annual family incomes ranged from $0 to $27,000 (in 1973
dollars), with a mean income of $13,687.

Items Regarding Functional Limitations

The HIS questionnaire items on functional limitations were con-
structed to measure three categories of limitations: a) mobility;
b) physical activity; and c) social role activity (including self-
care activities).

The *Mobility* items pertained to restrictions in travel in terms
of both range and freedom to move about from place to place. The
Physical Activity items pertained to limitations in physical movement,
including being confined to a bed or chair all day and having trouble
walking, stooping, bending, and climbing stairs. The *Social Role*

Activity items characterized activities typical for an individual of a given age and social role. Three activities were defined: major role, self-care, and other activities. Major role activities included role activities appropriate for a person's age, e.g., school, work, housework. Other activities referred to leisure activities, e.g., religious, recreational, or civic. Self-care activities referred to dressing, bathing, eating, and using the toilet. Self-care activities have been both combined with and scored separately from other functional limitations.[10,14,16,19,23,27,29,33] When self-care and other limitations have been combined, self-care has most often been included with social role activity limitations. The latter approach was followed in the current study.

Administration of Items

Questions regarding functional limitations were asked twice (four months apart on the average) of all members of the enrolled families. The first administration was done by an interviewer. All persons over 14 were asked to self-respond if present; all other responses were done by proxy, generally the head of household. In the second administration, questions were self-administered except in the case of persons requiring assistance.

First Administration. The first form of administration used cue cards for two of the categories (mobility and physical activity) and required respondents to choose the one limitation that best described his/her level of functioning.[24,27] For the social role activity category, items were asked in an hypothesized order of severity, beginning with items defining more severe limitations. If a respondent reported a limitation, all remaining items were skipped and limitations defined by those items were assumed.[24] The questionnaire items are presented in Appendix A.

For all items that were endorsed, the respondent was asked how long the limitation had been present. Two response categories were offered: a) less than one month; and b) more than one month. If the

latter response was made, respondents were asked how many months and years the limitation had been present.

Because the method of the first administration did not allow all items in each functional limitation category to be separately rated, scaling assumptions could not be tested. The ordinal nature of the scores obtained was assumed.

Second Administration. In the second administration of the functional limitations items, respondents separately rated each of the 14 items representing the three categories of functional limitations. Whenever a functional limitation was endorsed, the respondent rated the duration as follows: a) less than one month; b) one to three months; and c) more than three months. Thus, the scalability of limitations defined as acute (three months or less) or chronic (more than three months) could be tested. A list of items in each category, ____ding the hypothesized scale levels, is presented in Table 1. ____cond method of item administration allowed scaling assumpt____ to be tested.

Plan of Analysis

Analyses were performed to determine: a) scalability of items in the second administration; b) test-retest reliability of scale scores; c) validity of scale scores; and d) measurement precision. All analyses reported pertain to chronic limitations (those present for more than three months). This reflects the authors' interest in chronic as opposed to acute limitations and the fact that errors in response patterns observed during the scaling of acute limitations were reduced when only chronic limitations were scaled.

Scalogram Analysis. The 14 functional limitations items from the second administration were assigned to categories and scale levels were hypothesized as shown in Table 1. Scalogram analyses[13] were performed to evaluate the extent to which items in each category defined a unidimensional construct (i.e., the same construct was measured by the items) and were cumulative (i.e., ordered by degree of dysfunction). Following successful scalogram analysis, knowledge

of a respondent's scale score (i.e., scale type) permitted prediction of the exact pattern of responses to all items in the scale. For example, scale type 0 represented a pattern of negative responses to all functional limitations items in a given scale.

Two coefficients were used to evaluate the scalability of each group of items, in accordance with standard procedures. First, the coefficient of reproducibility $\left(CR = 1 - \dfrac{\text{observed errors}}{\text{total possible errors}}\right)$ was computed. All deviations from hypothesized response patterns (as determined by scalogram analysis) were initially counted as observed errors; the total possible number of errors is N times the number of items. A high CR value indicates both reliability and reproducibility; consistent with Edwards[9] and Guttman,[13] CR values of 0.90 or greater were accepted as evidence of the reliability/reproducibility of a given set of items. It is important, however, to examine the extent to which the observed CR is an improvement over the minimum CR; i.e., over the minimum marginal reproducibility (MMR). The improvement is represented in the coefficient of scalability $\left(CS = \dfrac{CR - MMR}{1 - MMR}\right)$, which indicates the proportion of possible improvement that was achieved. A recommended minimum standard for CS of 0.60 was accepted as evidence of the scalability of a given set of items.[26]

Because CR values were artificially inflated due to the very large proportion of persons who had no limitations, emphasis was placed on CS as evidence of the scalability of the items. In addition, a more conservative evaluation of the scalability of each group of items was achieved by reporting scalogram analyses for only those persons having one or more limitations.

Test-Retest Reliability. Additional reliability information consisted of correlations between functional limitations scale scores resulting from the two forms of administration (approximately four months apart). It should be noted that test-retest coefficients may have been attenuated because they reflect both the reliability of the

scales and the stability of chronic functional limitations. Attenuation may also have occurred as a result of differences in the alternate forms that were administered. Test-retest coefficients were computed for the total sample and separately for groups differing in educational attainment (2-9 years, 10-12 years, and more than 12 years of schooling).

Validity. Analyses of relationships among the functional limitations scales and between the scales and other health-related variables were performed to test validity hypotheses, including those pertaining to construct validity. Construct validation represents an attempt to understand what a scale measures when no adequate criterion (i.e., previously validated measure of that construct) exists. Three kinds of relationships which should exist if the scales measure what they were intended to measure were hypothesized: a) positive associations among the three scales; b) negative associations between the scales and positive definitions of health (e.g., physical ability) and positive associations between the scales and negative definitions of health (e.g., health worry/concern); and c) positive associations between the scales and age. Null hypotheses were tested regarding the relationships between the scales and education, income, and sex. Substantial associations among the functional limitations scales were hypothesized for three reasons: a) components of the same health constructs should be correlated; b) freedom from one kind of functional limitation is often a prerequisite to freedom from another; and c) data collection and scale construction methods used were the same.

To facilitate comparison of results from this study with those of Reynolds, Rushing, and Miles,[29] a score similar to their Function Status Index (FSI) was computed. The FSI for the current study represented the number of categories of functional limitations in which a respondent reported one or more limitations. A score of zero indicated no areas of limitations and a score of three indicated one or more chronic limitations in all three categories (mobility, physical activity, and social role activity).

Associations between functional limitations scale scores (and the FSI) and other health variables (also measured by self-administered questionnaire) were studied to gain additional understanding of the meaning of these scores. Five single-item or scale measures of health variables were developed for the HIS and used in this analysis:[*]

1. Physical abilities: defined by a 10-item summated ratings scale on which a high score indicated ability (internal-consistency reliability of 0.93).

2. General health rating scale: a seven-item summated ratings scale for which a high score indicated a favorable health rating (internal-consistency reliability of 0.88).

3. General health rating item: a commonly used single-item measure of health (in terms of excellent, good, fair, or poor) for which a high score indicated a favorable health rating; responses to this item were obtained during the first administration.

4. Health worry/concern: a single-item measure for which a high score indicated more worry, comparable to that used in the Reynolds et al.[29] study of the FSI. This item was also included in the general health rating scale, but was evaluated separately to allow comparison with results previously reported for the Reynolds et al. FSI.

5. Chronic disease conditions: specified by responses to questionnaire items and representing problems that occur frequently and can result in mild to severe disability, such as arthritis, bronchitis, and hay fever. These were scored to define the number of conditions (of a possible 32) that were judged to be definitely present according to algorithms used to define presence or absence of disease.[2] The nine most prevalent conditions were also scored according to severity, with a high score indicating

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[*] A list of items used in each of these measures is presented in Appendix B.

greater severity. Algorithms for computing severity scores from responses to questionnaire items were developed by two physicians.[2]

Coefficients of Association. The functional limitations scales were ordinal in nature, whereas scores for the validity variables (defined above) were either ordinal, interval, or ratio. In some instances, moreover, scale scores departed markedly from a normal distribution. For these reasons and in order to facilitate comparisons with results from other studies, three coefficients of association were computed to examine relationships between functional limitations scales and the variables used in validity studies. Product-moment correlations (r) were computed to yield parametric estimates of linear associations for metric data and of monotonic relationships for ranked data. Gamma coefficients (λ) were computed to estimate how much more probable it is to observe "like" than "unlike" order in two classifications.[11] Gamma is sensitive to curvilinear relationships. Tau coefficients (τ) are a kind of average measure of agreement with respect to order of rankings.[18] Ties in rankings were handled differently when taus were computed for symmetrical and nonsymmetrical classifications (i.e., variables having the same or a different number of levels); tau b was computed for symmetric and tau c was computed for nonsymmetric classifications.[26]

Precision. Precision was evaluated to determine the usefulness of the functional limitations scales in detecting differences between two groups in an experimental design that used a post-test only. Precision estimates were expressed in terms of the sample size needed to detect differences in functional limitations scores, with a chance probability of 0.05 or less for Type I errors (one-tailed test) and a power of 0.90 (i.e., a chance probability of 0.10 or less for Type II errors). Differences in scores (i.e., effect sizes) are conventionally expressed as some proportion of the population standard deviation.[4] Due to the skewed nature of the distributions

of the functional limitations scores, however, it was more appro-
priate to express each effect size as a percentage of the difference
between the population mean scale score and a perfect score. Since
a perfect score was zero, the effect size amounts to a percentage of
the mean. To facilitate interpretation, each percentage (i.e., each
effect size) was also expressed as the net number of differences in
functional limitations. For example, a net difference of two can
be achieved by one person improving two scale levels or by two
persons each improving one scale level. Since some changes in the
negative direction are possible (i.e., deterioration), it is impor-
tant to consider net group differences. Precision estimates (i.e.,
sample sizes) were calculated for three effect sizes representing
20, 40, and 60 percent of each scale mean. The net number of
differences in functional limitations associated with each of
these percentages is presented along with the results.

RESULTS

Scalogram Analysis

Hypothesized scales and items defining each scale level are shown in Table 1, along with the number and percentage of respondents who reported the presence of chronic functional limitations.

Mobility. The three items related to mobility limitations defined a reproducible scale with four scale types as hypothesized in Table 1 and shown in Table 2. For those having one or more mobility limitations (N = 16), the CR was 0.92 and the CS was 0.71. Thus, the criteria of scalogram analysis were satisfied.

Physical Activity. As shown in Table 2, a reproducible physical activity scale defining five scale types was achieved. One item, which contained a typographical error, was eliminated. Items 8 and 13, which pertained to trouble walking far and fast and trouble climbing stairs, were combined after being shown empirically to measure the same functional level, as hypothesized. A limitation at that level was scored when either or both items were endorsed. Items 10 and 12, which were hypothesized to measure the same functional level, did not. All persons who used supportive devices to walk were also in bed or a chair most of the day, whereas the opposite was not true. Therefore, the items were scored to define distinct levels. For those having one or more physical activity limitations (N = 109), CR was 0.96 and CS was 0.78 when the physical activity scale was scored as shown in Table 2.

Social Role Activity. A reproducible scale defining four scale types was achieved with the social role activity items after combining two items and eliminating a third (see Table 2). Items 2 and 3,

pertaining to limitations in kind of work and amount of work, were shown empirically to measure the same functional level, as hypothesized. A limitation at that level was scored when either or both items were endorsed. Item 4, pertaining to limitations in kind or amount of activity (other than major role activity), accounted for a disproportionately large number of scaling errors (53 of 76) and was eliminated. It should be noted that only three errors were attributable to the inclusion of self-care in the social role activities scale. For those having one or more social role activity limitations (N = 108), CR was 0.97 and CS was 0.81 when the scale was scored as shown in Table 2.

Reliability

Test-retest reliability estimates are shown in Table 3. For the total sample, product-moment correlations were 0.60 or greater and gamma coefficients exceeded 0.90 for all three scales. A slight trend toward higher reliability of scores for those people reporting highest educational attainment (more than 12 years) versus those reporting the lowest (2-9 years) was apparent.

Validity

Associations among functional limitations scales are shown in Table 4. The strongest relationship was observed between the physical and social role activity scales. All three measures of association between these two scales were high, suggesting a linear relationship. This interpretation was verified by inspection of cross-tabulations between scale scores and by an analysis of variance test of linearity. A noteworthy number of persons, however, appeared to have one type of limitation in the absence of the other.

Associations between mobility and physical activity, and between mobility and social role activity, were strong and in both instances the relationships were clearly curvilinear. Limitations in social role activity and physical activity were nearly always observed for those having one or more mobility limitations whereas the opposite was clearly not true.

Associations between functional limitations and physical abilities, general health ratings (both the single-item and scale), health worry/concern, and number of chronic disease conditions present are shown in Table 5. Functional limitations scores were most closely associated with physical abilities; as would be expected, associations were uniformly negative. Very strong associations were observed between functional limitations scales and the single-item and scale measures of general health. High gamma and relatively low tau and product-moment coefficients indicated curvilinear relationships; this was confirmed on inspection of cross-tabulations of general health ratings and functional limitations scores. Associations between responses to the single-item general health rating and functional limitations were very strong, but not quite as strong as for the general health rating scale. Coefficients were lowest (but still moderately high) for functional limitations in relation to the number of chronic disease conditions present (see Table 5). Relationships tended to be curvilinear. As shown in Table 6, two of the functional limitations scales were significantly related to eight of the nine most prevalent chronic diseases scored for severity. Patterns of association between functional limitations and these disease conditions were similar for physical and social role activity scales and coefficients were higher in both cases than for the mobility scale.

Associations among functional limitations scores and demographic and socioeconomic variables are shown in Table 7. As hypothesized, functional limitations demonstrated curvilinear relationships with age; note that gamma coefficients were high and positive and product-moment correlations were low and positive. Bivariate plots of age and functional limitations scores indicated that limitations tended to occur at an accelerating rate as age increased (see Figure 1). The relationship with age was similar for physical and social role activities; the relationship appeared to differ for mobility limitations, which occurred primarily after the age of 55.

Functional limitations scores were not significantly associated with sex. Limitations were slightly more frequent for nonwhite respondents. Consistent negative associations were observed between functional limitations and both education and family income. The strongest association was that between mobility and income. The relationships with education and income were curvilinear; limitations occurred at increasing rates as income and education decreased. Partial correlation analyses suggested that associations between functional limitations and both education and income remained significant even after controlling for age.

Precision. The results of the precision analyses and descriptive statistics for scale scores that are useful in interpreting these results are presented in Table 8. As a first step in considering these results, it is important to note the magnitude of each of the three effect sizes that were studied. In the case of the largest effect size (60 percent of the mean), a very large number of functional limitations would have to be eliminated. For example, the effect size would be about 60 percent in a two-group experiment if the second group were identical to the first at the end of the experiment except that each person in the second group had one less limitation.

As would be expected, required sample sizes varied considerably across the three effect sizes that were studied; approximately nine times as many persons would be necessary to detect the smallest as opposed to the largest effect size for all three scales. Results regarding physical and social activity scales were similar. For all effect sizes studied, approximately six to eight times as many persons would be required to detect similar differences in mobility as opposed to physical or social activity limitations.

It should be noted that if pre-experimental measures or covariates having correlations of $\rho = 0.60$ with the post-treatment measures are available, the required sample size may be reduced by a factor of ρ^2 or 36 percent. For example, to detect a difference in mobility of 20 percent of the mean, 49,600 persons would be required instead

of 77,500.   (Pre-experimental measures are available in the HIS and
test-retest correlations at four-month intervals are about 0.60.)

DISCUSSION

To be most useful as outcome measures of health, a battery of functional limitations questions should satisfy a number of conditions. First, the questions should be optimally scored so as to reduce the number of variables as much as possible without substantial loss of information. Second, the resulting score distributions should have sufficient variability to be useful in detecting differences in health for the intended populations and study designs. Third, the scores should be reliable. Fourth, the scores should be valid without being excessively redundant in relation to each other or to other health variables being measured. Finally, the battery should be practical in terms of data-gathering costs, respondent burden, and ease of scoring and interpretation. The functional limitations items in the HIS battery generally fulfilled these conditions, with some exceptions.

Cumulative scales were successfully constructed to measure functional limitations in each of the following categories: a) mobility; b) physical activity; and c) social role activity (which included self-care). For each of the latter two scales, however, it should be noted that departures from the hypothesized scales improved the scaling results. One of the five items hypothesized to measure social role activity limitations was eliminated because it accounted for a large number of scaling errors. In addition, two items hypothesized to measure the same physical activity level did not and were scored separately. Because of the revisions that were made *post hoc*, it is recommended that current study findings regarding the scalability of social role activity limitations and physical activity limitations be cross-validated. This is being done at HIS sites other than Dayton. It should also be noted that the findings apply to a general population (i.e., a primarily healthy population); thus,

they should not be generalized to a primarily disabled population without replication of the analyses described in this paper in such a population.

Distributions of scores for the three scales were markedly skewed, a finding consistent with those reported by others using similar methods in general populations.[27,29] Assuming that functioning is defined by a continuum ranging from very severe limitations to positive functioning, such skewed distributions suggest that the HIS scales and other currently available measures of functional limitations tap severe limitations only. To identify persons with less severe limitations (i.e., to reduce the skewness of the distributions), two approaches could be taken. First, a more comprehensive set of functions could be measured (e.g., intellectual functioning, emotions, and social interaction), as has been done by Gilson and others in developing the Sickness Impact Profile.[10] Second, items in existing areas of measurement that represent less severe limitations (e.g., limitations in hand movement or not working effectively) could be added to each of the three functional limitations categories. Either of these approaches would likely identify more persons with some functional limitation than do current measures. It would be important, however, to test the incremental validity of the new measures; i.e., to determine the extent to which they contribute information beyond that available from existing measures (e.g., general health perceptions, mental health).

One shortcoming of the functional limitation measures in the current study, particularly the mobility scale, is their relative inability to detect differences between groups in experiments involving general populations unless large sample sizes are used. Under the conditions that were studied, sample sizes required to detect the smallest of three effect sizes were approximately 10,000 for physical and social role activity limitations and 77,000 for mobility limitations. Required sample sizes could be reduced to 1,000 for the physical and social role activity scales and 8,600 for the mobility scale if only large differences were of interest,

namely, differences that required an average change of one functional limitation level for every person having one or more limitations. There are probably few if any ways in which the medical care system could be altered to produce a change of this magnitude. The sample sizes required to detect these differences would be even larger if the experimental design called for more than two groups. A considerable improvement in precision could be gained, however, through the use of a repeated-measures design.

A second strategy for improving the precision of these scales has already been implemented in the HIS. Additional items have been included in revised scales to detect a wider range of limitations along the lines discussed earlier. A list of revised items is presented in Appendix C. It has been hypothesized that their inclusion will decrease the proportion of persons who receive perfect scale scores and thereby improve scale precision. This hypothesis is currently being tested.

Associations among functional limitations scales were strong, supporting the existence of a general function-dysfunction construct underlying the three scale scores. Results suggest that freedom from mobility limitations is a prerequisite to freedom from limitations in physical and social role activities. If this finding is replicated, it may be possible to further aggregate mobility scores with physical or social role activity scores into a single indicator and thereby reduce the number of variables necessary to define these functional limitations (from three to two) with little or no loss of information. It appears that physical and social role activity limitations scales should continue to be scored and interpreted separately, pending determination of the extent to which persons who score differently on the scales represent valid differences in patterns of functional limitations as opposed to measurement errors.

Hypothesized associations between the three functional limitations scales and other survey measures of health were observed and tended to be strong, supporting the validity of the scales. Specifically, as the number of functional limitations increased, respondents

tended to report fewer physical abilities, more health worry/concern, poorer general health, more disease conditions, and tended to be older. The negative associations with measures of physical abilities were markedly strong, approaching values generally accepted as evidence that they measure the same as opposed to related constructs. The strength of these relationships is underscored because abilities and limitations measures were constructed using different scaling methods in this study. If replicated, these findings suggest that functional limitations and physical abilities, as measured in the current study, define opposite ends of a bipolar continuum ranging from dysfunction (functional limitations) to function (physical abilities) and could be scored accordingly, possibly using only two or three indicators. Further research is necessary to better understand and define bipolar (function-dysfunction) continuums corresponding to each of the functional limitations constructs.

Associations among functional limitations and the chronic diseases studied support the validity of all three scale scores and are generally consistent with results reported by others.[17,29] The extent to which the same functional limitations are manifested across a range of disease conditions should be studied further. Findings could be used in setting disease-specific outcome standards for assessing the quality of care. Attention should also be given to whether the relationships between functional limitations and disease conditions are linear or curvilinear. Reynolds et al.[29] reported a linear relationship between the number of chronic diseases present and their Function Status Index. Consistent with their findings, in this analysis, both the severity of individual chronic diseases and the number of chronic diseases present demonstrated monotonic relationships to functional limitations; unlike their findings, these relationships were curvilinear rather than linear.

Moderately strong associations between functional limitations and general health ratings have been reported.[17,29,31] Reynolds et al.[29] interpreted the associations as linear; Ware and Karmos[31] reported curvilinear relationships. In the current study, the three

functional limitations scales and the Function Status Index (FSI) demonstrated clear curvilinear relationships with general health ratings. Health worry/concern was considerably more strongly related to the functional limitations scales in the current study than to the FSI in the study reported by Reynolds and others.[29] It is plausible that their estimate of this relationship was attenuated due to lower reliability or heterogeneity of their FSI.

Consistent with findings reported by others,[15,17,29] scores for all three functional limitations scales and the FSI tended to increase with age. These relationships were clearly curvilinear in the current study; i.e., functional limitations were an increasing function of age. These curvilinear trends are also consistent with previous findings;[15,29] however, in the current study, the patterns appeared to be different across functional limitations scales. This finding is not consistent with conclusions drawn by others.[29]

Differences in patterns of relationships between functional limitations scores and either age or the other health variables studied suggest that the functional limitations scales should be scored and interpreted separately to preserve as much unique information about health as possible. Summary indicators should not be used without thorough consideration of tradeoffs between gains in efficiency and loss of information.

Functional limitations defined by items in each of the three scales were clearly cumulative in nature. Persons reporting a given level of dysfunction (e.g., can't walk) nearly always reported less severe limitations in activities of the same type (e.g., trouble climbing stairs). In addition to the importance of this finding in terms of desirable psychometric properties of the scales, the finding is of practical importance. Specifically, it should be possible to administer scale items in order of severity and, through the use of skip patterns, avoid administration of items defining limitations less severe than the limitation defined by the first item not endorsed: i.e., if a respondent cannot walk, there may be no point in asking if he/she can run. Once the scaling assumptions underlying

this strategy have been verified, the net result should be a sub-
stantial reduction in respondent burden without loss of information.

Generally speaking, associations between the health variables
and measures of chronic functional limitations in the current study
were strong enough to suggest that the functional limitations scales
measure health and weak enough to suggest that measures of function-
dysfunction constructs contribute unique and reliable information to
the measurement of health. Results of the current study and those
of other studies are not sufficient, however, to thoroughly under-
stand the extent to which various components of health (physical,
physiologic, mental, and social) are tapped by function-dysfunction
measures. Even less information is available regarding the extent
to which function-dysfunction measures tap variables that are not
traditionally included in the definition of health, e.g., willing-
ness to accept the patient role.[31] If policymakers are to use
measures of chronic functional limitations as a reflection of the
impact of medical care on health status, these unanswered questions
should be addressed in future research.

REFERENCES

1. Beck, A. T.: *Depression: Causes and Treatment*. Philadelphia, University of Pennsylvania Press, 1967.

2. Brook, R. H., Ware, J. E., Jr., et al.: *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Dayton*. R-1987-HEW. Santa Monica, California, The Rand Corporation, forthcoming.

3. Cantril, H.: *The Pattern of Human Concerns*. New Brunswick, N.J., Rutgers University Press, 1965.

4. Cohen, J.: *Statistical Power Analysis for the Behavioral Sciences*. New York, Academic Press, 1969.

5. Dohrenwend, B. P.: "Psychiatric Disorder in General Populations: Problem of the Untreated Case." *Am. J. Pub. Health* 60:1052, 1970.

6. Dohrenwend, B. P., Egri, G., and Mendelsohn, F. S.: "Psychiatric Disorder in General Populations: A Study of the Problem of Clinical Judgment." *Am. J. Psych*. 127:1304, 1971.

7. Dohrenwend, B. S., Dohrenwend, B. P., and Cook, D.: "Ability and Disability in Role Functioning in Psychiatric Patients and Non-patient Groups," in: Wing, J. K., and Hafner, H., eds.: *Roots of Evaluation*. London, Oxford University Press, 1973; pp. 337-360.

8. Dupuy, H. J.: "Developmental Rationale, Substantive, Derivative and Conceptual Relevance of the General Well-Being Schedule." Draft working paper, Rockville, Maryland, National Center for Health Statistics, June 1973.

9. Edwards, A. L.: *Techniques of Attitude Scale Construction*. New York, Appleton-Century-Crofts, Inc., 1957.

10. Gilson, B. S., Gilson, J. S., Bergner, M., et al.: "The Sickness Impact Profile: Development of an Outcome Measure of Health Care." *Am. J. Pub. Health* 65:1304, 1975.

11. Goodman, L. A., and Kruskal, W. H.: "Measures of Association for Cross-Classifications." *J. Am. Statis. Assoc*. 49:732, 1954.

12. Greenblatt, H. N.: *Measurement of Social Well Being in a General Population Survey.* Berkeley, Human Population Laboratory, California State Department of Health, 1975.

13. Guttman, L. A.: "A Basis for Scaling Qualitative Data." *Am. Sociol. Rev.* 9:139, 1944.

14. Haber, L. D.: "The Epidemiology of Disability: II. The Measurement of Functional Capacity Limitations," in: *Social Security Survey of the Disabled, 1966* (Report No. 10). Washington, D.C., Office of Research and Statistics, Social Security Administration, U.S. Department of Health, Education, and Welfare, July 1970.

15. Haber, L. D.: "Disabling Effects of Chronic Diseases and Impairment, II. Functional Capacity Limitations." *J. Chron. Dis.* 26:127, 1973.

16. Hulka, B., and Cassel, J. D.: personal communication, 1974.

17. Kaplan, R. M., Bush, J. W., and Berry, C. C.: "Health Status: Types of Validity for an Index of Well-Being." *Health Serv. Res.,* in press.

18. Kendall, M. G.: *Rank Correlation Methods.* London, Charles Griffin & Company, 1970.

19. Katz, S., Ford, A. B., Moskowitz, R. W., et al.: "Studies of Illness in the Aged." *J. Am. Med. Assoc.* 185:914, 1963.

20. Kessner, D. M., and Kalk, C. E.: *Strategy for Evaluating Health Services, Volume II: Contrasts in Health Status.* Washington, D.C., Institute of Medicine, National Academy of Sciences, 1973.

21. Morris, C.: "A Finite Selection Model for Experimental Design of the Health Insurance Study," in: American Statistical Association, *Proceedings of the Social Statistics Section.* Washington, D.C., American Statistical Association, 1975.

22. Myers, J. K., Lindenthal, J. J., and Pepper, M. P.: "Life Events and Psychiatric Impairment." *J. Nerv. Ment. Dis.* 152:149, 1971.

23. Nagi, S. Z.: "Congruency in Medical and Self-Assessment of Disability." *Industrial Medicine* 38:27, 1969.

24. National Center for Health Statistics: *Health Interview Survey Procedure, 1957-1974.* (Vital and Health Statistics Series 1, No. 11.) Rockville, Md., U. S. Department of Health, Education, and Welfare, 1975.

25. Newhouse, J. P.: "A Design for a Health Insurance Experiment." *Inquiry* 11:5, 1974.

26. Nie, H. H., Hull, C. H., Jenkins, J. G., et al.: *SPSS: Statistical Package for the Social Sciences* (second edition). New York, McGraw Hill, 1975.

27. Patrick, D. L., Bush, J. W., and Chen, M. M.: "Toward an Operational Definition of Health." *J. Health Soc. Behav.* 14:6, 1973.

28. Renne, K. S.: "Measurement of Social Health in a General Population Survey." *Soc. Sci. Res.* 3:25, 1974.

29. Reynolds, W. J., Rushing, W. A., and Miles, D. L.: "The Validation of a Function Status Index." *J. Health Soc. Behav.* 15:271, 1974.

30. Stewart, A. L., Ware, J. E., Jr., and Johnston, S.: *Construction of Scales Measuring Health and Health-Related Concepts from the Dayton Medical History Questionnaire*, in: R-1984-HEW. The Rand Corporation, forthcoming. (See reference no. 2.)

31. Ware, J. E., Jr., and Karmos, A. H.: *Development and Validation of Scales to Measure Perceived Health and Patient Role Propensity: Volume II of a Final Report*. Carbondale, Illinois, Southern Illinois University, 1976.

32. Ware, J. E., Jr.: *The Conceptualization and Measurement of Health for Policy Relevant Research in Medical Care Delivery*. P-5599. Santa Monica, California, The Rand Corporation, February 1976.

33. Williams, R. G. A., Johnston, M., Willis, L. A., et al.: "Disability: A Model and Measurement Technique." *Brit. J. Prev. Soc. Med.* 30:71, 1976.

34. World Health Organization: *The First Ten Years of the World Health Organization*. Geneva, World Health Organization, 1958.

Percent

100

80

60

40

20

0

14-24　25-34　35-44　45-54　55-64　65+

Age

● Social Activity
□ Physical Activity
◆ Mobility
▲ Function Status Index
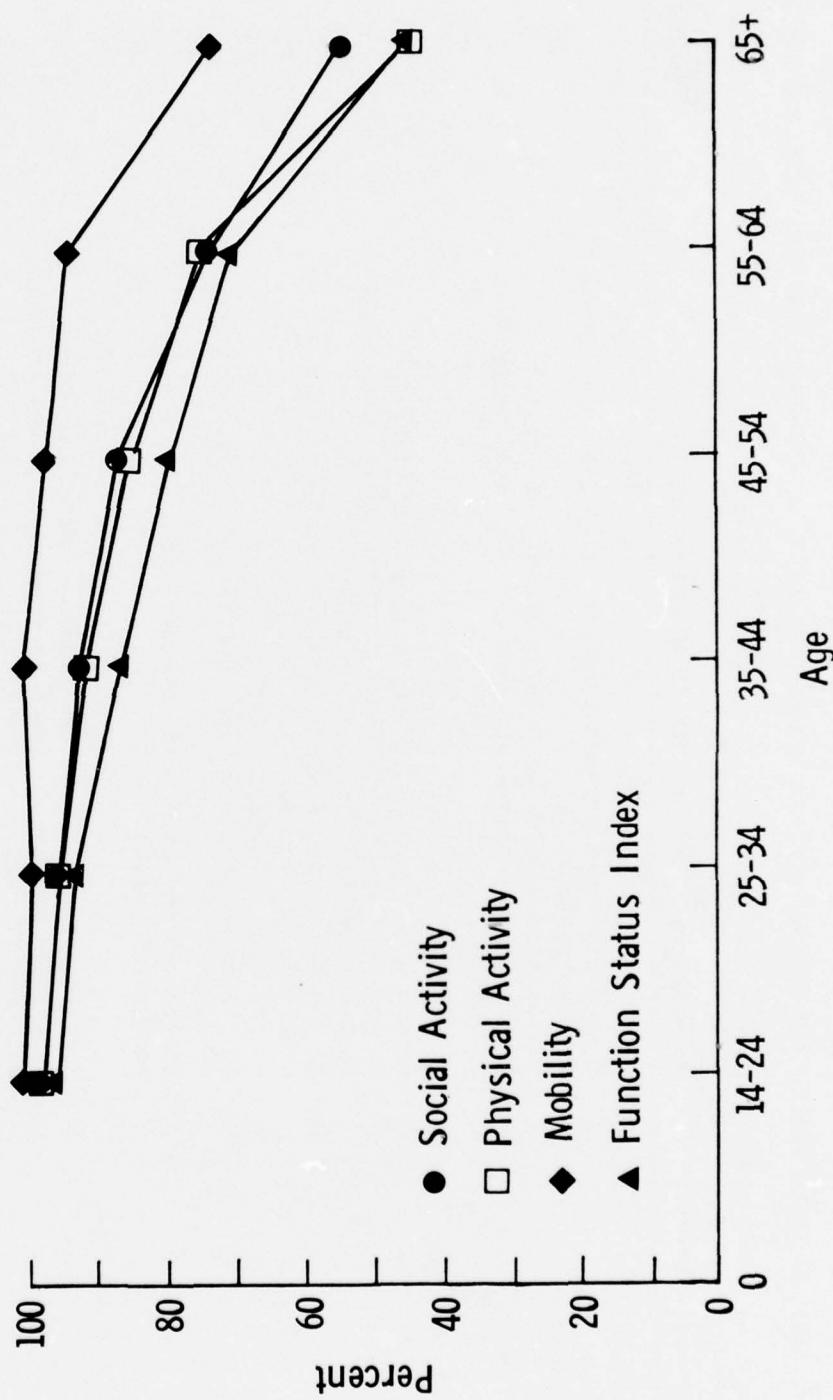
Table 1

HYPOTHESIZED SCALES AND NUMBER AND PERCENTAGE OF CHRONIC* LIMITATIONS REPORTED BY 1,209 RESPONDENTS

Scale/Scale Level	Item Number** and Content in HIS, Dayton, Ohio	Limitations Reported	
		Number	Percent
Mobility			
1	7 – Does your health prevent you from driving or using public transportation?	14	1.2
2	11 – Do you need help to go outside because of health?	8	0.7
3	14 – Are you in a hospital or other medical facility because of health?	4	0.3
Physical Activity			
1	13 – Do you have trouble climbing a flight of stairs?	71	5.9
	9 – Do you have trouble lifting, stooping, using chairs, or inclines (walking up ramps or hills)?***	129	10.7
	8 – Do you have trouble walking as far and as fast as is usual for persons your age?	88	7.3
2	6 – Do you have trouble walking?	42	3.5
	10 – Do you use canes, crutches, artificial limbs, or braces to walk?	10	0.8
3	12 – Are you in bed or a chair for most or all of the day because of health?	18	1.5
Social Role Activity			
1	4 – Does your health limit the kinds _or_ amounts of other activities you can do (such as sports, hobbies, reading, watching TV, and so forth)?	116	9.6
2	2 – Are you unable to do certain _kinds_ of jobs, housework, or schoolwork because of your health?	85	7.0
	3 – Does your health limit the _amount_ of work, housework, or schoolwork because of your health?	89	7.4
3	1 – Does your health keep you from working at a job, doing work around the house, _or_ going to school?	42	3.5
4	5 – Do you need help with eating, dressing, bathing, or using the toilet?	8	0.7

* A limitation present for more than three months.

** Item number indicates order in questionnaire.

*** Item 9 contained a typographical error ("chairs" was printed instead of "stairs") and was eliminated from the analysis.

Table 2

FUNCTIONAL LIMITATIONS SCALES DEFINED BY SCALOGRAM CRITERIA

Scale	Scale Type	Response Pattern*			Number	Percent	Adjusted Percent**
		Hospitalized (14)	Require Help to Go Outside (11)	Cannot Use Transportation (7)			
MOBILITY	3	yes	yes	yes	3	< 1	19
	2	no	yes	yes	5	< 1	31
	1	no	no	yes	8	< 1	50
	0	no	no	no	1193	99	-
					1209	100	100

Scale	Scale Type	Response Pattern*				Number	Percent	Adjusted Percent**
		Uses Supportive Devices to Walk (10)	In Bed or Chair Most of Day (12)	Trouble Walking (6)	Trouble with Stairs or Walking Fast (8 or 13)			
PHYSICAL ACTIVITY	4	yes	yes	yes	yes	8	< 1	7
	3	no	yes	yes	yes	6	< 1	6
	2	no	no	yes	yes	26	2	24
	1	no	no	no	yes	69	6	63
	0	no	no	no	no	1100	91	-
						1209	100	100

Scale	Scale Type	Response Pattern*			Number	Percent	Adjusted Percent**
		Needs Help Eating, Dressing, Bathing (5)	Cannot Work (1)	Work with Limitations (2 or 3)			
SOCIAL ROLE ACTIVITY	3	yes	yes	yes	5	< 1	5
	2	no	yes	yes	37	3	34
	1	no	no	yes	66	5	61
	0	no	no	no	1101	91	-
					1209	100	100

*Numbers in parentheses refer to individual items from Table 1.

**Percent of the total number of people in that scale with one or more limitation.

Table 3

TEST-RETEST[*] RELIABILITY ESTIMATES FOR FUNCTIONAL LIMITATIONS SCALES
FOR THE TOTAL SAMPLE AND GROUPS DIFFERING IN EDUCATIONAL ATTAINMENT

				Educational Level								
	2-9 Years (N=80)			10-12 Years (N=358)			13+ Years (N=250)			Total Sample (N=691)		
Scale	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ
Mobility	.60	.96	.10	.44	.98	.02	.81	1.00	.03	.60	.99	.03
Physical Activity	.51	.74	.24	.69	.97	.23	.61	.94	.06	.62	.93	.13
Social Role Activity	.68	.91	.34	.67	.93	.18	.65	.96	.11	.64	.93	.18

All coefficients significant at p < .01.
[*]Four-month interval between tests. Tau coefficient reported is tau c.

Table 4

ASSOCIATIONS AMONG FUNCTIONAL LIMITATIONS SCALES
AND TEST-RETEST RELIABILITY ESTIMATES

Scale*	Mobility		Physical Activity		Social Role Activity	
	r	γ	r	γ	r	γ
Mobility	[.60	.95]*				
Physical Activity	.62	.98	[.62	.93]		
Social Role Activity	.47	.97	.70	.94	[.64	.93]

All validity coefficients significant at $p < .001$ (N = 1,209).

*Test-retest (four-month interval between tests) reliability estimates for each scale appear along the diagonal of the entire matrix in brackets (N = 691).

Table 5

ASSOCIATIONS BETWEEN FUNCTIONAL LIMITATIONS SCALES
AND OTHER HEALTH MEASURES

Functional Limitations	Physical Abilities			General Health Rating Item			General Health Rating Scale			Health Worry/ Concern			Number of Chronic Diseases		
	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ
Mobility	-.68	-.98	-.04	-.29	-.96	(-.22)	-.27	-.90	-.03	.20	.85	(.15)	.17	.76	.03
Physical Activity	-.77	-.92	-.14	-.40	-.74	-.11	-.52	-.84	-.16	.36	.72	.14	.38	.72	.14
Social Role Activity	-.71	-.91	-.13	-.45	-.78	(-.33)	-.54	-.83	-.17	.39	.76	(.31)	.37	.68	.14
Function Status Index	-.70	-.92	-.17	-.48	-.73	(-.35)	-.59	-.80	-.22	.43	.72	(.33)	.45	.69	.19

All coefficients significant at p < .001; [N = 835 except for the General Health Rating Item (N = 695)]. Tau coefficient reported is tau b for symmetric tables and tau c for nonsymmetric tables (tau b coefficients are in parentheses).

Table 6

ASSOCIATIONS BETWEEN FUNCTIONAL LIMITATIONS SCALES AND SELECTED CHRONIC DISEASES

| | Functional Limitations Scales | | | | | | | | | | | |
| | Mobility | | | Physical Activity | | | Social Role Activity | | | Function Status Index | | |
	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ
Obesity	.00	.13	.00	.12**	.46	.04**	.06*	.34	.03**	.10**	.43	.05**
Arthritis	.14**	.65	.02**	.36**	.74	(.33**)	.32**	.68	.10**	.39**	.69	.14**
Congestive Heart Failure	.11**	.58	.01**	.35**	.81	(.39**)	.35**	.74	.08**	.43**	.78	.11**
Shortness of Breath	.10**	.56	.01**	.40**	.81	.09**	.35**	.74	.08**	.43**	.78	.11**
Myocardial Infarction	.10**	.50	.01*	.28**	.66	.08**	.30**	.66	.08**	.33**	.66	.11**
Angina Pectoris	.10**	.71	.01**	.25**	.77	.06**	.27**	.78	.06**	.31**	.78	.08**
Bronchitis	.00	.02	.00	.12**	.40	.05**	.15**	.46	(.16**)	.16**	.43	(.17**)
Ulcer	-.01	-.18	.00	.10**	.38	.04**	.13**	.40	.05**	.15**	.40	.07**
Hay Fever	-.04	-1.00	(-.05)	-.03	.04	.00	.01	.20	(.05)	.01	.14	(.04)

* p < .05.
** p < .01.

Tau coefficient reported is tau b for symmetric tables and tau c for nonsymmetric tables (tau b coefficients are in parentheses).

Table 7

ASSOCIATIONS BETWEEN FUNCTIONAL LIMITATIONS SCALES AND
DEMOGRAPHIC AND SOCIOECONOMIC VARIABLES

	Age			Sex			Family Income			Education			Race[a]		
	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ	r	γ	τ
Mobility	.16**	.82	.02**	.02	.20	.00	-.08**	-.56	-.02**	-.08**	-.48	-.01**	.06*	.44	.01
Physical Activity	.30**	.60	.11**	.01	.09	.02	-.13**	-.29	-.05**	-.16**	-.42	-.07**	.06*	.27	.02*
Social Role Activity	.24**	.54	.10**	.01	.05	.01	-.11**	-.24	-.04**	-.15**	-.33	-.05**	.05*	.20	.02
Function Status Index	.30**	.54	.14**	.03	.12	.03	-.14**	-.24	-.06**	-.19**	-.37	-.08**	.06*	.20	.02*

N = 1193 to 1209.
* p < .05.
** p < .01.
[a] Race was scored dichotomously; 1 = white, 2 = nonwhite.

Table 8

DESCRIPTIVE STATISTICS FOR SCALE SCORES AND
RESULTS OF PRECISION ANALYSES

	Scale		
	Mobility	Physical Activity	Social Role Activity
Mean	.022	.141	.128
Standard Deviation	.212	.523	.445
Number of persons observed with one or more limitations (HIS data)	16	109	108
Total number of limitations observed (HIS data)[a]	27	171	155
Net differences in limitations required for three effect sizes[b]			
20% mean	5	34	31
40% mean	11	68	62
60% mean	16	103	93
Sample sizes required to detect three effect sizes[c]			
20% mean	77,500	11,800	9,200
40% mean	19,400	3,000	2,300
60% mean	8,600	1,300	1,000

[a] Sum of limitations across persons.

[b] Rounded to the nearest integer.

[c] Two group experimental design, which employed only a post-test, with α = .05 (one-tailed test) and power = 0.90.

Appendix A

ITEMS USED TO MEASURE FUNCTIONAL LIMITATIONS

IN THE FIRST ADMINISTRATION

Scale   Item number and content

Mobility   3.08 Which of these statements best describes you in terms of health?

1. Patient in a hospital, nursing home, mental hospital.
2. Must stay inside all day or need help to go outside because of health.
3. Cannot drive or use public transportation without help because of health.
4. Not restricted in driving or using public transportation because of health.

Physical Activity   3.06 Which of these statements best describes you in terms of health?

1. In bed or in a chair for most or all of the day because of health.
2. Move own wheelchair without help.
3. Walk with one or more of the following limitations:

    --use cane, crutches, artificial limb, or braces, or

    --have trouble lifting, stooping, using chairs or inclines, or

    --have trouble walking as far or as fast as usual for other persons of the same age.
4. Walk without any of the physical limitations listed above.

Social
Role
Activity

3.10 Do you need any help with eating, dressing, bathing, or using the toilet because of health?

Ages 18 and older

(If not working or keeping house)   (If working or keeping house)

3.16* Does your health currently keep you from working?

3.21* In terms of health, are you currently able to (keep house/work at all)?

3.33 Are you limited in any way because of a disability or because of your health?

Ages 14-17

(If going to school in past 12 months)   (If not going to school in past 12 months)

3.27* (Does/would) (NAME) have to go to a certain type of school because of his/her health?

3.26* In terms of health would (NAME) be able to go to school?

3.28* (Is (NAME)/would (NAME) be) limited in school attendance because of (his/her) health?

3.29* Is (NAME) limited in the kind or amount of other activities because of his/her health?

If response was yes, respondent skipped all remaining items.

Appendix B

ITEMS USED IN CORRELATIONAL STUDIES

Scale/Concept	Content
Physical Abilities	
1	Can you dress yourself?
2	Can you walk to a table for meals?
3	Can you walk around inside the house?
4	Can you walk a block or more?
5	Can you do light work around the house?
6	Can you walk uphill or upstairs?
7	Can you run a short distance?
8	Can you move light furniture, vacuum, and lift or push up to 25 pounds?
9	Can you take part in sports such as swimming, bowling, golf?
10	Can you do harder activities at home, such as mow lawns, mop floors?
General Health Rating Scale	
1	During the past 3 months, how often has your health kept you from doing the kinds of activities other people your age do?
2	During the past 3 months, how much pain have you had?
3	During the past 3 months, how much has your health worried or concerned you?
4	During the next 12 months, do you expect your health will be excellent, good, fair, or poor?
5	How often were you bothered by any illness, bodily disorder, aches or pains? (during the past month)
6	Did you feel healthy enough to carry out the things you like to do or had to do? (during the past month)
7	Have you been concerned, worried, or had any fears about your health? (during the past month)

General Health
  Rating Item

    1   Would you say your health in general is
                                 excellent, good, fair, or poor?

Health Worry/
  Concern

    1   During the past 3 months, how much has your
                                 health worried or concerned you?

List of Diseases Included in Number of Chronic Disease Conditions

1. Obesity*
2. Arthritis*
3. Congestive Heart Failure*
4. Shortness of Breath*
5. Myocardial Infarction*
6. *Angina Pectoris*
7. Bronchitis*
8. Smoker
9. Alcoholism
10. Behavioral Impairment Due to Alcohol
11. Cirrhosis of the Liver
12. Blood Pressure Problems
13. Ulcer*
14. Hayfever*
15. Hearing Problems
16. Teeth Problems
17. Tuberculosis
18. Hernia
19. Anemia
20. Kidney Disease
21. Urinary Tract Infection
22. High Cholesterol
23. Problems with Seeing Close

24. Problems with Seeing Far

25. Glaucoma

26. Thyroid Problems

27. Syphilis

28. Gonorrhea

29. Varicose Veins

30. Acne

31. Hemorrhoids

32. Diabetes

*Severity also scored.

Appendix C

REVISED LIST OF FUNCTIONAL LIMITATIONS ITEMS

Category	Questionnaire Placement and Item Content

Mobility

1. Are you able to drive a car?

   --No, because of my health.

   --No, for some other reason.

   --Yes, able to drive car

2. When you travel around your community, does someone have to assist you because of your health?

3. Do you have to stay indoors for most or all of the day because of your health?

4. Are you in bed or a chair for most or all of the day because of health?

Physical Activity

5. Does your health limit the kind of vigorous activities you can do, such as running, lifting heavy objects, or participating in strenuous sports?

6. Do you have any trouble either walking several blocks or climbing a few flights of stairs because of your health?

7. Do you have trouble bending, lifting or stooping because of your health?

8. Do you have any trouble either walking one block or climbing one flight of stairs because of your health?

9. Are you unable to walk unless you are assisted by another person or by a cane, crutches, artificial limbs or braces?

Social Role   10. Are you unable to do certain kinds or amounts
Activity   of work, housework, or schoolwork because of
                   your health?

              11. Does your health keep you from working at a job,
                   doing work around the house, or going to school?

Self-Care   12. Do you need help with eating, dressing, bathing,
Activity   or using the toilet because of your health?

General   13. Does your health limit you in any way from
Limitation   doing anything you want to do?

A STUDY OF THE RELIABILITY, VALIDITY, AND PRECISION OF SCALES TO
MEASURE CHRONIC FUNCTIONAL LIMITATIONS DUE TO POOR HEALTH

Stewart, Ware
and Brook